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THE INSTITUTE OF THE AERONAUTICAL SCIENCES

NEW YORK, N. Y., JANUARY 27, 1958, 1:00 PM (EST)

SPACE TECHNOLOGY AND THE NACA

By

Hugh L. Dryden
Director, National Advisory Committee for Aeronautics

The topic of our day is the new frontier, space, and the new challenge, the conquest of space. The escape of objects and man himself from the earth into space has long been the subject of science fiction writers and the comic strip artists. More recently, it has been a matter of interest to a growing number of serious-minded scientists. Now, it has acquired a new sense of imminence and reality. Space travel has stirred the imagination of man to an extraordinary degree. It is, however, one thing to desire to travel in space, and quite another to satisfy that desire. Early accomplishment of this goal will require major advances in science and technology.

This effort will stimulate industrial and economic development. Space vehicles will open the way to acquisition of much new knowledge about the earth and the universe. They will enable development of new military weapons. They will bring great national prestige.

The launching of the first man-made satellite on October 4th of last year produced an extreme swing of the pendulum from general lack of interest in space travel and even ridicule of its proponents, to expectation of early interplanetary flight. This essentially emotional reaction may make it very difficult to proceed with a sound program. Engineers have a special responsibility to be bold and imaginative, and yet they must be thoroughly realistic and practical. We must do our share in acquainting the public with the characteristic difference between engineering and technology, and other professions and fields of endeavor.

In many professions, for example law, education, diplomacy, the spoken or written word plays a dominant role in accomplishment. The lawyer prepares a brief with great care, but often the key factor is the skill with which he pleads his case, and thus persuades others to accept his conclusions. Law makers debate the issues and resolve them by compromise and majority vote. Similarly in other fields, in sales and even in banking. A characteristic feature is that when the discussion ends in decision, the result is immediately at hand. There is no time lag or only a very small time lag between decision and accomplishment.

In engineering there is also much discussion, debate, and compromise. But when decision is reached to build a bridge, an airplane or a space craft, there remains the "hardware" construction. The materials of our physical world can not be talked or

argued with the desired shape. There is a long time lag between the decision and the completion of the bridge, or airplane, or space craft. Like the time span between conception and birth of a child, no amount of discussion or investment of money can reduce this time interval to zero. Thus travel to the moon by manned or unmanned vehicles will require more than discussion and decision and allocation of funds. It will require much effort and time and will be soonest achieved by a systematic and orderly program of research and development. The public must be understanding and patient with the scientists and engineers in addition to providing the necessary funds.

I wish to discuss with you briefly my own views as to what the national program should be, the role of research, and specifically the role of the NACA. In speaking of the program as a national program I do not wish to exclude the possibility of the program being an international one; its technical character would be the same.

In my opinion the goal of the program should be the development of manned satellites and the travel of man to the moon and nearby planets. I omit for the present travel outside the solar system since the probable travel times seem well beyond the adult life of an individual even with optimistic extrapolations of known science and technology. The immediate goals should be more limited, and these I will discuss a little later.

There is rather good agreement that there are at least three general aspects of an adequate space program. These are: (1) research in space technology to provide data for the design of useful and efficient vehicles, the provision of a safe environment for man and otherwise to insure the success of manned space flight operations; (2) design and development of scientific and military space vehicles and their launching, flight, and recovery; and (3) research on the phenomena of the high upper atmosphere and nearby space, such as the character and distribution of matter, cosmic rays, solar radiation, electric, magnetic, and gravitational fields, etc., and scientific studies of the universe made possible by the use of satellites and space platforms as observation sites.

You know as well as I, how eagerly those in astronomy, geophysics, and meteorology -- to name only three of the interested scientific groups -- anticipate the tremendous advantages that will result from such observation sites in space.

The development and operation of military missiles, military satellites and military space vehicles are clearly a military function and it is well understood that a vigorous program is necessary. It is not so well understood by the general public that additional vehicles and operations will be required for scientific research on space phenomena and scientific exploration of the universe, in addition to those employed for research in space technology. The national program must include both non-military and military aspects. It is perhaps the non-military aspects of space flight that will have the

greatest impact on the thinking and the future of all mankind.

The organization of the national effort is receiving much study. As you know the President and the Secretary of Defense have announced the formation of an Advanced Research Projects Agency within the Department of Defense to which responsibility for military space projects is to be assigned. Responsibility for non-military aspects has not yet been fully determined. Some groups have recommended the creation of a completely new independent civilian agency of government to conduct research and development in its own laboratories or by contract, to contract for and sponsor development of components and vehicles, and to engage in space flight operations. Some of these proposals restrict the activities of the proposed new agency to non-military projects; others include at least the research aspects of military projects.

The basic reason underlying these proposals for a new civilian agency is plain. The scientific community, understandably, is worried about the possibility that the extremely important non-military aspects of space technology would be submerged or perhaps even lost if included as a mere adjunct to a military program.

There is another solution to the problem of how best to administer the national space-technology program, one which clearly recognizes the essential duality of our goals -- the prompt and full exploitation of the potentials of flight into space for both scientific and military purposes. Actually, this solution is old and well-tested. It is explicitly

stated in the 1915 legislation that established the National Advisory Committee for Aeronautics with responsibility to "supervise and direct the scientific study of the problems of flight, with a view to their practical solution...." The Committee structure of the NACA embraces both the non-military and the military elements of aeronautics. The researches of the NACA are designed to be useful to both the non-military and the military segments of aeronautics. The entire operation of the NACA is based upon the premise that coordinated teamwork effort by all parties concerned provides the surest guarantee of progress in aeronautics.

At its meeting on January 16, 1958 the National Advisory Committee for Aeronautics expressed its view that the national space program can be most rapidly, effectively, and efficiently implemented by the cooperative effort of the Department of Defense, the National Advisory Committee for Aeronautics, the National Academy of Sciences and the National Science Foundation together with universities, research institutions, and industrial companies of the nation. Under this plan the National Science Foundation in collaboration with the National Academy of Sciences would plan scientific experiments and assign priorities for research on space phenomena for basic scientific purposes as previously described. The National Science Foundation would assume responsibility for financial support of scientists in the detailed planning, design and construction of special apparatus, related research and analysis of data for approved projects.

The National Advisory Committee for Aeronautics would conduct flights for scientific purposes when within its capabilities or jointly, with appropriate agencies of the Department of Defense, in the successful pattern of the research airplane programs. The NACA would also coordinate and conduct research in space technology in its own laboratories and by contract in support of both military and non-military projects.

Since the end of World War II the NACA has been engaged increasingly in research applicable to the problems of space flight and has designed and constructed the special aerodynamic, structural, and propulsion facilities required for this work. For example, studies were formally initiated in 1952 leading to the X-15 research airplane project, a cooperative project between the NACA, Air Force, and the Navy. North American Aviation is now building the X-15 and it is scheduled to make its first flight in about one year. The X-15 will be used to explore problems of manned flight into nearby space particularly the control of the attitude of the vehicle in space in the absence of aerodynamic forces, the safe return from space to the atmosphere without destructive heating, and the effect of weightlessness on the pilot.

The NACA is also engaged in studies of satellite configurations suitable for safe re-entry at still higher speeds, both for manned and unmanned flight. The present program is far from adequate. Our rate of progress in solving the problems of space flight must be very

greatly increased. The problem is essentially one of extension and expansion of effort. For this purpose new research facilities will be needed at existing laboratories and at new laboratories, including a launching site for space flights for research purposes. A larger staff will of course be needed. A greatly expanded contract research program is similarly essential to obtain assistance from groups with special competence in specific areas. Thus special talents, experienced staffs, and facilities of existing organizations can be pooled for the accelerated effort that is required. I would emphasize that these organizations already have demonstrated that they can work together successfully, and, perhaps equally important, that they have established the necessary close relationships with the scientific community and with industry.

To provide material assistance in its program the NACA recently appointed a Special Committee on Space Technology under the chairmanship of Dr. H. G. Stever, Associate Dean of Engineering of the Massachusetts Institute of Technology. A partial list of the members of the new committee includes:

Mr. H. Julian Allen, Ames Aeronautical Laboratory

Dr. Hendrik W. Bode, Director of Mathematical Research,
Bell Telephone Laboratories

Dr. Milton U. Clauser, Director of Aeronautical Laboratory,
The Ramo-Wooldridge Corporation

Prof. Dale R. Corson, Cornell University

Mr. James R. Dempsey, Manager, Astronautics Division,
Convair

Mr. Robert R. Gilruth, Langley Aeronautical Laboratory

Mr. S. K. Hoffman, General Manager, Rocketdyne Division,
North American Aviation, Inc.

Dr. W. Randolph Lovelace, II, Lovelace Clinic

Dr. William H. Pickering, Director, Jet Propulsion Laboratory,
California Institute of Technology

Dr. Louis N. Ridenour, Jr., Missile Systems Division,
Lockheed Aircraft Corporation

Mr. Abe Silverstein, Lewis Flight Propulsion Laboratory

Dr. James A. Van Allen, Department of Physics, State
University of Iowa

Dr. Wernher von Braun, Director, Development Operations
Division, Army Ballistic Missile Agency.

The committee will also include representatives of the Air Force
and Navy not yet designated.

This committee will take a fresh look at the research and
development problems of space technology and make recommendations
as to the needed programs. The first meeting of the committee has
been scheduled for February 13th. The major research fields which
must find a place in the overall national program include space
mechanics; space environment; energy sources; propulsion systems;
vehicle configuration and structure; materials; launch, rendezvous,
re-entry, and recovery; communication, navigation, and guidance;
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By Hugh L. Dryden



This important policy statement was prepared by Dr. Dryden for presentation as a luncheon address at the Institute's 26th Annual Meeting.

In Dr. Dryden's absence, it was delivered by John C. Victory, Executive Secretary of the NACA, on January 27, 1958.

The topic of our day is the new frontier, space, and the new challenge, the conquest of space. The escape of objects and man himself from the earth into space has long been the subject of science fiction writers and the comic strip artists. More recently, it has been a matter of interest to a growing number of serious-minded scientists. Now, it has acquired a new sense of imminence and reality. Space travel has stirred the imagination of man to an extraordinary degree. It is, however, one thing to desire to travel in space and quite another to satisfy that desire. Early accomplishment of this goal will require major advances in science and technology.

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National Advisory Committee for Aeronautics

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The design and development of vehicles should proceed simultaneously with research on space technology. While the goal is manned flight to planets within the solar system, the vehicle program must proceed in step-by-step fashion. We have something to learn from the U.S.S.R. experience. So far as we know, they began as did we—with a supply of German V-2 rockets and the aid of German scientists and engineers. In contrast to our own development, their program proceeded in logical steps with consistent support from top government officials and at high priority. Larger and larger rockets were developed by the U.S.S.R. scientists leading to ballistic missiles of steadily increasing range, with many missiles built and fired. A group was organized for scientific work on phenomena in the high atmosphere using rockets. In addition to physical apparatus, animals were sent aloft, including dogs. As experience was gained and reliability in

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No. 33

Space Technology and the National Advisory Committee for Aeronautics

EXTENSION OF REMARKS OF

HON. HARRY FLOOD BYRD

OF VIRGINIA

IN THE SENATE OF THE UNITED STATES

Monday, March 3, 1958

Mr. BYRD. Mr. President, I ask unanimous consent to have printed in the Appendix of the RECORD a very able speech delivered by Dr. Hugh L. Dryden, Director, National Advisory Committee for Aeronautics, entitled "Space Technology and the NACA"; also a resolution adopted by the National Advisory Committee for Aeronautics. The NACA conducts an aeronautical laboratory near Hampton, Va.

There being no objection, the address and resolution were ordered to be printed in the RECORD, as follows:

SPACE TECHNOLOGY AND THE NACA

(Address delivered by Hugh L. Dryden, Director, National Advisory Committee for Aeronautics, at luncheon meeting of the Institute of the Aeronautical Sciences, New York, N. Y., January 27, 1958)

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The basic reason underlying these proposals for a new civilian agency is plain. The scientific community, understandably, is worried about the possibility that the extremely important nonmilitary aspects of space technology would be submerged or perhaps even lost if included as a mere adjunct to a military program.

There is another solution to the problem of how best to administer the national space-technology program, one which clearly recognizes the essential duality of our goals—the prompt and full exploitation of the potentials of flight into space for both scientific and military purposes. Actually, this solution is old and well-tested. It is explicitly stated in the 1955 legislation that established the National Advisory Committee for Aeronautics with responsibility to supervise and direct the scientific study of the problems of flight, with a view to their practical solution. The committee structure of the NACA embraces both the nonmilitary and the military elements of aeronautics. The researches of the NACA are designed to be useful to both the nonmilitary and the military segments of aeronautics. The entire operation of the NACA is based upon the premise that coordinated teamwork effort by all parties concerned provides the surest guaranty of progress in aeronautics.

At its meeting on January 16, 1958 the National Advisory Committee for Aeronautics expressed its view that the national space program can be most rapidly, effectively, and efficiently implemented by the cooperative effort of the Department of Defense, the National Advisory Committee for Aeronautics, the National Academy of Sciences and the National Science Foundation together with universities, research institutions, and industrial companies of the Nation. Under this plan the National Science Foundation in collaboration with the National Academy of Sciences would plan scientific experiments and assign priorities for research on space phenomena for basic scientific purposes as previously described. The National Science Foundation would assume responsibility for financial support of scientists in the detailed planning, design and construction of special apparatus, related research and analysis of data for approved projects. The National Advisory Committee for Aeronautics would conduct flights for scientific purposes when within its capabilities or jointly, with appropriate agencies of the Department of Defense, in the successful pattern of the research airplane programs. The NACA would also coordinate and conduct research in space technology in its own laboratories and by contract in support of both military and nonmilitary projects.

Since the end of World War II the NACA has been engaged increasingly in research applicable to the problems of space flight and has designed and constructed the special aerodynamic, structural, and propulsion facilities required for this work. For example, studies were formally initiated in 1952 leading to the X-15 research airplane project, a cooperative project between the NACA, Air Force, and the Navy. North American Aviation is now building the X-15 and its scheduled to make its first flight in about 1 year. The X-15 will be used to explore problems of manned flight into nearby space particularly the control of the attitude of the vehicle in space in the absence of aerodynamic forces, the safe return from space to the atmosphere without destructive heating, and the effect of weightlessness on the pilot.

The NACA is also engaged in studies of satellite configurations suitable for safe reentry at still higher speeds, both for manned and unmanned flight. The present program is far from adequate. Our rate of progress in solving the problems of space flight must be very greatly increased. The problem is essentially one of extension and expansion of effort. For this purpose new research facilities will be needed at existing laboratories and at new laboratories, including a launching site for space flights for research purposes. A larger staff will, of course, be needed. A greatly expanded contract research program is similarly essential to obtain assistance from groups with special competence in specific areas. Thus special talents, experienced staffs, and facilities of existing organizations can be pooled for the accelerated effort that is required. I would emphasize that these organizations already have demonstrated that they can work together successfully, and, perhaps equally important, that they have established the necessary close relationships with the scientific community and with industry.

To provide material assistance in its program the NACA recently appointed a special committee on space technology under the chairmanship of Dr. H. G. Stever, associate dean of engineering of the Massachusetts Institute of Technology. A partial list of the members of the new committee includes:

Mr. H. Julian Allen, Ames Aeronautical Laboratory.

Dr. Hendrik W. Bode, director of mathematical research, Bell Telephone Laboratories.

Dr. Milton U. Clauser, director of aeronautical laboratory, the Ramo-Wooldridge Corp.

Prof. Dale R. Corson, Cornell University.

Mr. James R. Dempsey, manager, astronautics division, Convair.

Mr. Robert R. Gilruth, Langley Aeronautical Laboratory.

Mr. S. K. Hoffman, general manager, Rocketdyne division, North American Aviation, Inc.

Dr. W. Randolph Lovelace II, Lovelace Clinic.

Dr. William H. Pickering, director, jet propulsion laboratory, California Institute of Technology.

Dr. Louis N. Ridenour, Jr., missile systems division, Lockheed Aircraft Corp.

Mr. Abe Silverstein, Lewis Flight Propulsion Laboratory.

Dr. James A. Van Allen, department of physics, State University of Iowa.

Dr. Wernher von Braun, Director, Development Operations Division, Army Ballistic Missile Agency.

The committee will also include representatives of the Air Force and Navy not yet designated.

This committee will take a fresh look at the research and development problems of space technology and make recommendations as to the needed programs. The first meeting of the committee has been scheduled for February 13. The major research fields which must find a place in the overall national program include space mechanics; space environment; energy sources; propulsion systems; vehicle configuration and structure; materials; launch, rendezvous, reentry, and recovery; communication, navigation, and guidance; space biology; flight simulation; measurement and observation techniques.

The design and development of vehicles should proceed simultaneously with research on space technology. While the goal is manned flight to planets within the solar system, the vehicle program must proceed in stepwise fashion. We have something to learn from the U. S. S. R. experience. So far as we know, they began as did we, with a supply of German V-2 rockets and the aid of German scientists and engineers. In contrast to our own development, their program proceeded in logical steps with consistent support from top government officials and at high priority. Larger and larger rockets were developed by the U. S. S. R. scientists, leading to ballistic missiles of steadily increasing range, with many missiles built and fired. A group was organized for scientific work on phenomena in the high atmosphere, using rockets. In addition to physical apparatus, animals were sent aloft, including dogs. As experience was gained and reliability increased, the first satellite was launched, followed soon by the second carrying the dog, Laika. It is said that Laika had already been aloft on a rocket and been safely returned. Probably the Sputnik II was the same type of rocket used in that work, now boosted into satellite orbit by large rockets from the ballistic-missile program.

We need a similar step-by-step program, each step fully tested. I think there will be needed two parallel lines of vehicle development, one unmanned, which should be able to proceed rapidly, and the other man-carrying, whose development will probably be somewhat slower. I personally am unwilling to be a party to trying to put a brave young pioneer into orbit until his demonstrated chance of successful return is much better than 50 percent. The earliest vehicles will be progressively larger unmanned satellites, carrying more and more complex equipment to perform more and more difficult scientific and engineering tasks. We may expect these to be followed by unmanned vehicles which travel around the moon, and later those which land on it. This line of development has already attained its first objective.

Concurrently, there should be a systematic program on manned vehicles. The X-15 is a research tool to get some experience in flight into nearby space. Other projects should be initiated promptly toward the goal of manned satellite flight. As the chief milestones are passed, other, more advanced goals should be set.

We have the talents and the resources to assure that we in America can lead the way. It is imperative, for the peace and welfare of the world, that we shall lead the way.

As I think about what lies ahead, I am reminded of the comment of Wilbur Wright, voiced many years ago: "It is not necessary to look too far into the future; we see enough already to be certain that it will be magnificent."

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS RESOLUTION ON THE SUBJECT OF SPACE FLIGHT, ADOPTED JANUARY 16, 1958

Whereas the National Advisory Committee for Aeronautics is authorized by act of Congress (U. S. Code, title 50, sec. 151) to "supervise and direct the scientific study of the problems of flight, with a view to their practical solution . . . and to direct and conduct research and experiment in aeronautics"; and

Whereas the advancing flight performance of unmanned vehicles has reached outside the atmosphere into nearby space and the exploration of space by manned vehicles will soon begin; and

Whereas in the opinion of the Committee, the broad authority in its organic act includes the investigation of problems relating to flight in all its aspects, outside of, or within the earth's atmosphere, of aircraft, missiles, satellites, and outer-space projectiles and vehicles; and

Whereas the problems of space technology include energy sources, propulsion, materials, structures, control, guidance, communication, environment, launching, recovery, and human limitations and requirements with respect to the flight of such vehicles; and

Whereas since the end of World War II the National Advisory Committee for Aeronautics has been increasingly engaged in research applicable to the problems of space flight and has designed and constructed the special aerodynamic, propulsion, and structures facilities required for this work; and

Whereas the National Advisory Committee for Aeronautics in 1952 formally initiated studies of the problems associated with unmanned and manned flight at altitudes from 50 miles up and at speeds from mach number 10 to the velocity of escape from the earth's gravity which resulted in the cooperative NACA-USAF-USN project, the X-15 research airplane designed and now under construction for studying some of the problems of manned flight in nearby space; and

Whereas the urgency of an adequate national program of research and development leading to manned satellites, lunar, and interplanetary flight is now apparent:

Be it resolved, That the National Advisory Committee for Aeronautics express its view that an adequate national program must enlist the scientific and engineering resources of the Nation and must include:

1. Research in space technology to provide data for the design of useful and efficient vehicles and to insure the success of manned space flight operations.

2. Design and development of scientific and military space vehicles and their launching, flight and recovery.

3. Research on the phenomena of the high upper atmosphere and nearby space, such as the character and distribution of matter, cosmic rays, solar radiation, electric, magnetic, and gravitational fields, etc., and scientific studies of the universe made possible by the use of satellites and space platforms as observation sites.

Be it further resolved, That the National Advisory Committee for Aeronautics express its view that the national program can be most rapidly, effectively, and efficiently implemented by the cooperative effort of the Department of Defense, the National Advisory Committee for Aeronautics, the National Academy of Sciences, and the National Science Foundation, together with universities, research institutions, and industrial companies of the Nation.